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EXAMINER

BODDIE, WILLIAM

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2629

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Please find below and/or attached an Office communication concerning this application or proceeding.

DETAILED ACTION

1. On a communication dated March 27th, 2006, claims 1, 6-8, 11, 14-18 were amended and new claim 19 was added. Claims 1-19 are currently pending in the application.

Response to Applicant's Arguments

2. Applicant's arguments with respect to claims 1-19 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claim 19 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 19 includes the limitation that the modulation is an overdrive modulation. There is no mention or definition of overdrive modulation within the original disclosure. Lacking support for overdrive modulation within the original disclosure this limitation is seen as new matter.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-2, 6-8, 11, 14 and 17-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomizawa et al. (US 2002/0180883) in view of Usui et al. (US 5,347,294).

With respect to claim 1, Tomizawa discloses, a method for driving a group of pixels (fig. 2) in a display device to display an image of a respective frame based on an interlace signal for displaying an image of a respective frame from video signals of a plurality of fields (para. 1), said method comprising:

generating driving signals (Image data in fig. 8) based on video signals of a current field (current field (interlaced) in fig. 8), so as to drive the group of pixels for displaying the frame image;

modulating the driving signals for driving the group of pixels (12 in fig. 8), by referring to video signals of a previous field (previous field (progressive) in fig. 8);

interpolating video signals for the previous field (22 in fig. 8) before modulating the driving signals (note that 22 is prior to 12 in fig. 8), so as to generate video signals of one frame (fig. 4); and

interpolating video signals for the current field (21 in fig. 8) before modulating the driving signals (note that 21 is prior to 12 in fig. 8), so as to generate video signals of one frame (fig. 4); and

in said modulating step, the driving signals being respectively modulated for the group of pixels by referring to video signals of the previous field (fig. 8, also see para. 89) used to generate the driving signals for the respective pixels.

Tomizawa does not expressly disclose, adjusting strength of modulation in said modulating step based on a comparison between video signals of the current field and video signals of an earlier of previous two fields.

Usui discloses, a display device (fig. 18) that adjusts the strength of modulation (gray scale data) in a modulating step based on a comparison between video signals of the current field and video signals of an earlier of previous two fields (col. 7, lines 34-40; col. 12, line 48 – col. 13, line 3; col. 15, lines 7-12; also note claim 1.).

Usui and Tomizawa are analogous art because they are both from the same field of endeavor namely, image display processing control circuitry and data comparison.

At the time of the invention it would have been obvious to one of ordinary skill in the art to adjust the modulation strength of the current field of Tomizawa, based on a comparison between the current and previous corresponding field, as taught by Usui.

The motivation for doing so would have been to increase the response speed, allowing quick response and high image quality (Usui; col. 2, lines 1-13).

Therefore at the time of the invention it would have been obvious to combine Usui with Tomizawa for the benefit of a high image quality to obtain the invention as specified in claim 1.

With respect to claim 2, Tomizawa and Usui disclose, the method as set forth in claim 1 (see above)

Tomizawa further discloses, wherein in at least one of interpolating video signals for the previous field and interpolating video signals for the current field video signals are interpolated for a respective line of a field other than a target field of interpolation in such a manner that the interpolated video signals contain the same information as target field video signals of a frame line adjacent to the interpolated line (fig. 7, teaches copying the same information to construct a full frame).

With respect to claim 6, Tomizawa and Usui disclose, the method as set forth in claim 1 (see above).

Tomizawa further discloses, wherein; two fields make up one frame (see above),

With respect to claim 7, Tomizawa and Usui disclose, the method as set forth in claim 1 (see above).

Usui further discloses, said step of adjusting strength of modulation, modulation is stopped in said modulating step when the video signals of the current field substantially match the video signals of the earlier of the previous two fields (col. 19, lines 58-65).

With respect to claim 8, Tomizawa and Usui disclose, the method as set forth in claim 1 (see above).

Usui further discloses, said step of adjusting strength of modulation, strength of modulation is gradually reduced from a full strength to zero strength according to a difference between the video signals of the current field and the video signals of the earlier of the previous two fields, if the difference falls within a predetermined range. (note the gradually different levels in fig. 9; col. 6, lines 6-18).

With respect to claim 11, no new limitations different from claim 1 are found. It appears that claim 11 is merely an apparatus claim with identical limitations seen above in claim 1. As Tomizawa and Usui teach a driving device (see title) claim 11's rejection is based on the same grounds as shown above for the rejection of claim 1.

With respect to claim 14, Tomizawa and Usui disclose, the driving device as set forth in claim 11 (see above),

Usui further discloses, corresponding-field video signal generating means (321 in fig. 21) for storing the video signals of the current field (Input in fig. 21) until input of a field having video signals on corresponding positions, and for outputting the stored video signals as corresponding-field video signals (output in fig. 21), wherein the driving signal generating means compares the corresponding-field video signals with the video signals of the current field (322 in fig. 21), and, based on a result of comparison, varies strength of facilitation of a grayscale level transition from the previous to current field, so as to generate the driving signals (col. 10, lines 58-66; col. 12, line 64 – col. 13, line 3; also note claim 1.).

With respect to claim 17, it would have been obvious to one of ordinary skill in the art to construct a computer program that would enable the implementation of the methods of claim 1. The motivation for doing so would be to make the aforementioned method viable as a piece of hardware in the commercial market. With regard to the recited steps of claim 17, as these steps do not add any new limitations over claim 1, they are rejected on the same merits as described above in claim 1.

With respect to claim 18, as claim 18 only further limits claim 17 by stating that the computer program is located on a recording medium, and further more as it is

obvious to one of ordinary skill in the art to include a computer program on a recording medium, for portability reasons, claim 18 is rejected on the merits as claim 17.

With respect to claim 19, Tomizawa and Usui disclose, the method of claim 1 (see above).

Usui further discloses, wherein the modulation is an overdrive modulation facilitating a grayscale transition from a previous frame to a current frame (col. 6, lines 6-19).

7. Claims 12-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomizawa et al. (US 2002/0180883) in view of Usui et al. (US 5,347,294) further in view of Nakanishi (US 5,488,389).

With respect to claim 12, Tomizawa and Usui disclose, the driving device as set forth in claim 11 (see above).

Tomizawa further discloses, wherein the interlace signal produces an image of one frame from images of two fields (fig. 5 for example), as well as that the previous-field interpolating means includes a field memory for storing the video signals (23 in fig. 10).

While Tomizawa does disclose interpolating means that copy lines of fields, neither Usui nor Tomizawa expressly disclose, wherein the current-field interpolating means includes a line memory for storing video signals of one line of the current field, and for outputting the video signals of one line twice by doubling a frequency of a dot clock for the interlace signal, and control means, by referring to the output of the line memory, for causing the field memory to store the video signals of respective lines of

the current field, and for causing the field memory to output the video signals of respective lines of the previous field twice at the frequency of the line memory.

Nakanishi discloses, wherein the current-field interpolating means includes a line memory (Nakanishi, 46 in fig. 38) for storing video signals of one line of the current field, and for outputting the video signals of one line twice by doubling a frequency of a dot clock (Nakanishi, 47 in fig. 38) for the interlace signal (Nakanishi, col. 25, lines 17-38), and wherein the previous-field interpolating means includes: a field memory (Nakanishi, 43 in fig. 44) for storing the video signals of respective lines of the current field and holding the stored video signals until a next field; and control means (Nakanishi, 44 in fig. 44), by referring to the output of the line memory, for causing the field memory to store the video signals of respective lines of the current field, and for causing the field memory to output the video signals of respective lines of the previous field twice at the frequency of the line memory (Nakanishi, col. 25, lines 17-38).

Nakanishi, Usui and Tomizawa are all analogous art because they are from the same field of endeavor namely image display processing control circuitry and data comparison.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to utilize line memories and field memories, as taught by Nakanishi in the undescribed I/P conversion sections of Tomizawa and Usui.

The motivation for doing so would have been to display a more natural image and decrease the effects of thinning (Nakanishi, col. 3, lines 65-67).

Therefore it would have been obvious to combine Nakanishi with Tomizawa and Usui for the benefit of simplified circuitry to obtain the invention as specified in claim 12.

With respect to claim 13, Tomizawa and Usui disclose, the driving device as set forth in claim 11 (see above).

Tomizawa further discloses, wherein the interlace signal produces an image of one frame from images of two fields (fig. 5 for example), the current-and-previous video signal generating means includes a field memory for outputting the interlace signal with a delay of one field (fig. 13).

Neither Usui nor Tomizawa explicitly disclose what is included in the interpolating means.

Nakanishi discloses, current-field interpolating means includes a current-field line memory (Nakanishi, 23 in fig. 25) for storing video signals of one line of the current field, and for outputting the video signals of one line twice by doubling a frequency of a dot clock for the interlace signal (c2 in fig. 26), and wherein the previous-field interpolating means includes a previous-field line memory (Nakanishi, 46 in fig. 44) for storing video signals of one line outputted from the field memory, and for outputting the stored video signals of one line twice at the frequency of the current-field line memory (Nakanishi, col. 25, lines 17-38).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to utilize line memories and field memories, as taught by Nakanishi in the undescribed I/P conversion sections of Tomizawa and Usui.

The motivation for doing so would have been to display a more natural image and decrease the effects of thinning (Nakanishi, col. 3, lines 65-67).

Therefore it would have been obvious to combine Nakanishi with Tomizawa and Usui for the benefit of simplified circuitry to obtain the invention as specified in claim 13.

8. Claims 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomizawa et al. (US 2002/0180883) in view of Usui et al. (US 5,347,294) further in view of Nakanishi (US 5,488,389) and Choquet et al. (US 4,937,667).

With respect to claim 15, Tomizawa and Usui disclose, the driving device as set forth in claim 11 (see above), wherein the interlace signal produces an image of one frame from images of two fields (see above).

Usui further discloses, comparing means for comparing the video signals of the current field outputted from the current-field interpolating means with the video signals of the previous-corresponding-field with respect to each pixel (77 in fig. 8), and for outputting a result of comparison for each pixel (output of 77 in fig. 8); and the adjusting means adjusts the strength of modulation for the driving signals of the respective pixels based on the result of the comparison (col. 12, lines 64-68).

Neither Tomizawa nor Usui expressly disclose the specific memories used in the device.

Choquet discloses, the current-field interpolating means includes a current-field line memory ($ML\phi$ in fig. 3) for storing video signals of one line of the current field ($t+1$ in fig. 3), and for outputting the stored video signals of one line twice by doubling a frequency of a dot clock for the interlace signal ($2x_{fe}$ in fig. 15; col. 16, lines 19-27), and

said driving device further comprises,

a field memory (MT1-2 in fig. 3) for storing the video signals of the current field until input of a later of next two fields ($t+1$, $t-1$ in fig. 3),

control means for causing the field memory to output video signals of one line of the previous field (t in fig. 3) alternately with video signals of one line of a previous-corresponding-field ($t-1$ in fig. 3), and

a field line memory (ML2 in fig. 3) for storing the video signals of one line of the previous-corresponding-field outputted from the field memory (MT2 in fig. 3),
wherein

the previous-field interpolating means includes a previous-field line memory (ML1 in fig. 3) for storing the video signals of one line outputted from the field memory (MT1 in fig. 3).

At the time of the invention it would have been obvious to one of ordinary skill in the art to utilize line memories and field memories, as taught by Choquet in the undescribed I/P conversion sections of Tomizawa and Usui, for the benefit of a simple, fast and effective deinterlace technique (Choquet, col. 2, lines 14-19).

While Choquet discloses, doubling a frequency of a dot clock for the interlace signal and driving a line memory with the doubled clock ($2x_{fe}$ in fig. 15; col. 16, lines 19-27), neither Choquet nor Tomizawa or Usui expressly disclose doubling the clock for all of the line memories.

Nakanishi discloses, doubling the clock for multiple line memories (col. 25, lines 17-38; fig. 47(1-8)) which are equivalent to many of Choquet's line memories for the benefit of a more natural display screen (Nakanishi; col. 3, lines 65-67).

At the time of the invention it would have been obvious to double the clock speed of the memories of Choquet, Tomizawa and Usui as taught by Nakanishi.

Nakanishi, Choquet, Usui and Tomizawa are all analogous art because they are from the same field of endeavor namely image display processing control circuitry and data comparison.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to combine these teachings of Tomizawa, Nakanishi, Choquet, and Usui for the benefit of achieving a more efficient driving signal upon output to obtain the invention as specified in claim 15.

With respect to claim 16, Tomizawa and Usui disclose, the driving device as set forth in claim 11 (see above).

Claim 16 recites many of the same limitations seen in claim 15. Therefore these limitations are rejected on the same basis as stated above in claim 15.

The only further limiting factor of claim 16 is the inclusion of: a comparison-result line memory for storing the result of comparison for one line.

Choquet further discloses a comparison-result line memory (Mi in fig. 14) for storing the result of comparison for one line, and for outputting the stored result twice at the frequency of the current-field line memory (2xfe in fig. 15).

9. Claims 3-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomizawa et al. (US 2002/0180883) in view of Usui et al. (US 5,347,294) further in view of Huang (US 6,295,091).

With respect to claim 3, Tomizawa and Usui disclose, the method as set forth in claim 1 (see above).

Tomizawa further discloses, wherein two fields make up one frame (fig. 5 for example).

Neither Usui nor Tomizawa expressly disclose, in as least one of interpolating video signals for the previous field and interpolating video signals for the current field, video signals are interpolated for a respective line of a field other than a target field of interpolation in such a manner that the interpolated video signals contain the same information as video signals obtained by averaging target field video signals obtained by averaging target field video signals respectively of a pair of frame lines adjacent to the interpolated line.

Huang discloses, in as least one of said interpolating video signals for the previous field and interpolating video signals for the current field, video signals are interpolated for a respective line of a field other than a target field of interpolation in such a manner that the interpolated video signals contain the same information as video signals obtained by averaging target field video signals obtained by averaging target field video signals respectively of a pair of frame lines adjacent to the interpolated line (fig. 4).

Tomizawa, Usui and Huang are all analogous art because they are from the same field of endeavor, namely image display processing and data comparison..

At the time of the invention it would have been obvious to a person of ordinary skill in the art to perform the adjacent line averaging method, taught by Huang, in the i/p conversion means of Tomizawa and Usui.

The motivation for doing so would have been to eliminate motion artifacts that are present in other methods (Huang, col. 3, 50-53).

Therefore, it would have been obvious to combine Usui, Tomizawa and Huang for the benefit of eliminating motion artifacts to obtain the invention as specified in claim 3.

With respect to claim 4, Tomizawa and Usui disclose, the method as set forth in claim 1 (see above), wherein: two fields make up one frame (see above);

Neither Usui nor Tomizawa expressly disclose, in at least one of interpolating video signals for the previous field and interpolating video signals for the current field, video signals are interpolated for a respective line of a field other than a target field of interpolation in such a manner that the interpolated video signals contain the same information as target field video signals respectively of a pair of frame lines adjacent to the interpolated line, and that video signals for respective pixels of the interpolated line are generated based on video signals for a plurality of pixels in one of the pair of frame lines and based on video signals for a plurality of pixels in the other line of the pair of frame lines.

Huang discloses, in at least one of said interpolating video signals for the previous field and interpolating video signals for the current field, video signals are interpolated for a respective line of a field other than a target field of interpolation in such a manner that the interpolated video signals contain the same information as target field video signals respectively of a pair of frame lines adjacent to the interpolated line, and that video signals for respective pixels of the interpolated line are generated based on video signals for a plurality of pixels in one of the pair of frame lines and based on video signals for a plurality of pixels in the other line of the pair of frame lines (fig. 6).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to utilize the interpolation method, taught by Huang, in the i/p conversion means of Tomizawa and Usui.

The motivation for doing so would have been to eliminate “jaggies’ (stair-step artifacts on diagonal lines)” (Huang, col. 4, lines 20-22).

Therefore, it would have been obvious to combine Usui, Tomizawa and Huang for the benefit of eliminating stair-step artifacts to obtain the invention as specified in claim 4.

With respect to claim 5, Tomizawa and Usui disclose, the method as set forth in claim 1 (see above), wherein: two fields make up one frame (see above);

Neither Usui nor Tomizawa disclose in at least one of interpolating video signals for the previous field and interpolating video signals for the current field, video signals are interpolated in a respective line of a field other than a target field of interpolation based on target field video signals respectively of a pair of frame lines adjacent to the interpolated line and based on video signals in adjacent fields of the target field.

Huang discloses, at least one of interpolating video signals for the previous field and interpolating video signals for the current field, video signals are interpolated in a respective line of a field other than a target field of interpolation based on target field video signals respectively of a pair of frame lines adjacent to the interpolated line and based on video signals in adjacent fields of the target field (fig. 5).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to utilize the interpolation method, taught by Huang, in the i/p conversion means of Tomizawa and Usui.

The motivation for doing so would have been for a sharper picture than is present in other methods (Huang, col. 3, 53-56).

Therefore, it would have been obvious to combine Usui, Tomizawa and Huang for the benefit of a sharper picture to obtain the invention as specified in claim 5.

10. Claims 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomizawa et al. (US 2002/0180883) in view of Usui et al. (US 5,347,294) further in view of Gadeyne et al. (US 6,909,472).

With respect to claim 9, Tomizawa and Usui discloses, the method as set forth in claim 1 (see above).

Neither Usui nor Tomizawa expressly disclose, in said modulating step, the driving signals for the group of pixels are modulated so as to facilitate a grayscale level transition from the previous field to the current field; and the grayscale level transition in said modulating step is facilitated such that, when a pixel undergoes a grayscale level transition from the previous field to the current field by repeating a cycle of grayscale level transition between a first grayscale level and a second grayscale level, an integrated value of luminance for the pixel takes an intermediate value between the first grayscale level and the second grayscale level by causing whichever faster of a response speed with the strongest level of facilitation for a first-to-second grayscale level transition and a response speed with the strongest level of facilitation for a second-to-first grayscale level transition to approach whichever slower of the two response speeds.

Gadeyne discloses, in said step modulating step, the driving signals for the group of pixels are modulated so as to facilitate a grayscale level transition from the previous

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field to the current field; and the grayscale level transition in said modulating step is facilitated such that, when a pixel undergoes a grayscale level transition from the previous field to the current field by repeating a cycle of grayscale level transition between a first grayscale level and a second grayscale level, an integrated value of luminance for the pixel takes an intermediate value between the first grayscale level and the second grayscale level by causing whichever faster of a response speed with the strongest level of facilitation for a first-to-second grayscale level transition and a response speed with the strongest level of facilitation for a second-to-first grayscale level transition to approach whichever slower of the two response speeds (col. 3, lines 45-52).

Tomizawa and Gadeyne are analogous art because they are from the same field of endeavor, namely generation of driving signals to be applied to displays.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to combine the gradation response embodiment of Gadeyne, with the display circuitry disclosed by Tomizawa.

The motivation for doing so would have been to eliminate motion artifacts caused by different luminance response times (Gadeyne, abstract).

Therefore, it would have been obvious to combine Tomizawa and Gadeyne for the benefit of eliminating motion artifacts to obtain the invention as specified in claim 9.

With respect to claim 10, Tomizawa, Usui and Gadeyne disclose, the method as set forth in claim 9 (see above).

Gadeyne further discloses, the grayscale level transition in said step (II) is facilitated in such a manner that a grayscale level transition with the slowest response

speed with the strongest facilitation determines response speeds of other grayscale level transitions, with the slowest response speed substantially matching the other response speeds (col. 3, lines 45-52).

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to William Boddie whose telephone number is (571) 272-0666. The examiner can normally be reached on Monday through Friday, 7:30 - 4:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amr Awad can be reached on (571) 272-7764. Please note the new Central Fax Number 571-273-8300. Faxes sent to the old number, 703-872-9306, will be routed to the new number until September 15, 2005.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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AMR A. AWAD
PRIMARY EXAMINER

